

1 "Surface Cleaning Apparatus"

2

3 This invention relates to surface cleaning
4 apparatus, and particularly, but not exclusively, to
5 surface cleaning apparatus using a cleaning roller
6 and an adhesive roller for removing contamination
7 from sheet materials such as phototools and screens
8 for LCD displays.

9

10 Apparatus of this type is well known, and makes use
11 of a cleaning roller having a surface of relatively
12 low tackiness in contact with an adhesive roller of
13 relatively high tackiness. The workpiece is passed
14 over the cleaning roller which picks up contaminants
15 which are then transferred to and retained by the
16 adhesive roller. Commonly, the workpiece is passed
17 between two cleaning rollers, each with its own
18 adhesive roller, to clean both sides of the
19 workpiece simultaneously.

20

21 A problem with such apparatus is that, if the
22 cleaning roller and the adhesive roller are left

1 stationary and in contact with each other, "wetting"
2 or transfer of adhesive from the adhesive roller to
3 the cleaning roller will occur, which will have an
4 adverse effect on the operation of the cleaning
5 roller. This problem has previously been addressed
6 in a number of ways.

7

8 The simplest provides a manually operable means such
9 as a lever which the operator can use to separate
10 the cleaning roller(s) from the adhesive roller(s).
11 This requires only a simple mechanism, but there is
12 a high probability of the operator using the system
13 incorrectly. In particular, no fail-safe mechanism
14 is provided to cause the adhesive roller(s) to
15 separate from the cleaning roller(s) when they are
16 stationary, for example, in the event of a power
17 failure.

18

19 A common approach is to move the mounting of the
20 adhesive roller by pneumatic cylinders. However,
21 this requires the use of pneumatic cylinders and the
22 provision of a compressed air supply and a suitable
23 electro-pneumatic control system. This adds
24 considerably to the cost and complexity of the
25 apparatus.

26

27 It is also known to produce relative movement
28 between cleaning roller(s) and adhesive roller(s) by
29 means of solenoids or electromagnets, but
30 arrangements for doing this have hitherto been
31 mechanically cumbersome and have required relatively
32 complex control circuitry.

1
2 A further feature of cleaning machines of this
3 general type is that it is necessary from time to
4 time to remove the cleaning rollers and the adhesive
5 rollers, for example to perform extra cleaning on
6 the cleaning rollers or to replace these, and to
7 expose fresh areas of adhesive on the adhesive
8 rollers or to replace these. It is known to mount
9 the cleaning rollers and adhesive rollers in a
10 removable cartridge, in an attempt to facilitate
11 these operations. However, known cartridge systems
12 are not provided with systems to avoid stationary
13 contact between cleaning roller and adhesive roller.

14
15 According to the present invention there is provided
16 surface cleaning apparatus for cleaning a sheet
17 material comprising a base unit and a roller
18 cartridge removably insertable into said base unit;
19 said roller cartridge comprising a cleaning roller
20 and a co-operating adhesive roller wherein the
21 respective rollers are mounted for relative movement
22 between (i) a first non-operating position in which
23 the cleaning roller and adhesive roller are
24 separated; and (ii) a second operating position in
25 which the cleaning roller abuts against the adhesive
26 roller; and wherein the base unit and the roller
27 cartridge are each provided with formations adapted
28 to interact to produce said relative movement as the
29 roller cartridge is inserted into and removed from
30 the base unit.

1 Preferably, the roller cartridge comprises a further
2 opposed cleaning roller having a co-operating
3 adhesive roller, the respective cleaning rollers
4 being adapted for cleaning opposite surfaces of the
5 sheet material.

6

7 Preferably, opposing walls extend from the base
8 unit, said walls being adapted to receive and
9 support opposing ends of the roller cartridge.

10

11 Preferably, at least one end of the roller cartridge
12 is provided with a moveable plate comprising at
13 least one cut-out portion, the or each cut-out
14 portion defining a cartridge cam surface adapted to
15 receive a bearing axle of an adhesive roller.

16

17 Preferably, the bearing axles are biased towards
18 each other by a first resilient means.

19

20 Preferably, the moveable plate is slidably mounted
21 for movement between a first position in which
22 separation of the bearing axles is maximised and a
23 second position in which the separation of the
24 bearing axles is minimised; and wherein the moveable
25 plate is biased towards said first position by a
26 second resilient means.

27

28 Preferably, the interacting formations are
29 respectively (i) at least one inclined slot formed
30 in at least one wall of the base unit, the or each
31 inclined slot defining a base unit cam surface; and
32 (ii) at least one bearing member projecting from the

1 or each moveable plate of the roller cartridge; the
2 or each bearing member adapted to bear on its
3 corresponding base unit cam surface.

4

5 Preferably, the or each base unit cam surface is
6 adapted to move its corresponding bearing member
7 against the bias of the second resilient means upon
8 progressive insertion of the roller cartridge into
9 the base unit.

10

11 Preferably, the or each cartridge cam surface allows
12 the first resilient means to move the bearing axles
13 towards their minimum separation upon movement of
14 the moveable plate against the bias of the second
15 resilient means.

16

17 Preferably, the roller cartridge is adapted to be
18 inserted vertically into the base unit.

19

20 Alternatively, the roller cartridge is adapted to be
21 inserted horizontally into the base unit.

22

23 Preferably, the longitudinal axis of the or each
24 bearing member and the rotational axis of the or
25 each adhesive roller are respectively parallel.

26

27 Alternatively, the longitudinal axis of the or each
28 bearing member and the rotational axis of the or
29 each adhesive roller are respectively perpendicular.

30

31 Preferably, the apparatus comprises a retaining
32 means adapted to releasably retain the cleaning

1 roller and the adhesive roller in the second
2 operating position.

3

4 Preferably, the retaining means adapted to release
5 the roller cartridge from its operating position in
6 the event of a power failure.

7

8 Preferably, the retaining means comprises an
9 electromagnet and a magnet.

10

11 Preferably, a driving motor is provided to power the
12 apparatus and wherein the electromagnet is
13 selectively activated upon activation of said
14 driving motor.

15

16 Preferably, two inclined slots are provided in each
17 wall of the base unit, said slots being laterally
18 offset with respect to each other.

19

20 Embodiments of the invention will now be described,
21 by way of example only, with reference to the
22 drawings, in which:

23

24 Fig. 1 is an isometric view of a cleaning
25 machine forming one embodiment of the invention, in
26 an operating condition;

27 Fig. 2 is a similar view of the same machine in
28 a non-operating condition;

29 Fig. 3 is a similar view of the machine of
30 Fig. 1 with a roller cartridge removed;

31 Fig. 4 is an isometric view corresponding to
32 Fig. 3 but taken from another angle;

1 Fig. 5 is an isometric view corresponding to
2 Figs. 3 and 4 from the rear;

3 Fig. 6 is an isometric view of the roller
4 cartridge in a non-operating condition;

5 Fig. 7 is a view similar to Fig. 6 showing the
6 cartridge in an operating condition;

7 Fig. 8 is a perspective schematic view
8 illustrating a second embodiment;

9 Fig. 8A is a detail of tracks in the machine of
10 Fig. 8; and

11 Fig. 9 is a perspective schematic view
12 illustrating a further embodiment.

13

14 Figs. 1 to 7 show surface cleaning apparatus
15 comprising a base unit 10 and a removable roller
16 cartridge 12.

17

18 Referring particularly to Figs. 3-5, the base unit
19 10 has a supporting portion 14 and upstanding
20 opposing walls 16. An electric motor 18 (best seen
21 in Fig. 3) drives a pinion 20 which in turn drives a
22 drive gear 22. An in-feed conveyor 24 and an out-
23 feed conveyor 26 are driven via pinions 28 and belts
24 30.

25

26 The drive gear 22 has the function of powering the
27 roller assembly, as will be described below. It
28 will also be noted from Figs. 3-5 that inward faces
29 of the opposing walls 16 are formed with inclined
30 slots 32 which define base unit cam surfaces. An
31 electromagnet 34 is secured to the supporting
32 portion 14 of the base unit 10.

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2 Referring now particularly to Figs. 6 and 7, the
3 roller cartridge 12 includes a pair of cleaning
4 rollers 36a and 36b journaled for rotation in side
5 members 38a and 38b and biased together by resilient
6 means (not shown) to form a resilient nip. When the
7 roller cartridge 12 is in the operational position
8 the cleaning rollers 36 are driven by the drive gear
9 by means of a pinion 42.

10

11 Each cleaning roller 36a and 36b is associated with
12 a respective adhesive roller 40a and 40b. When the
13 surface cleaning apparatus is in operation, each
14 cleaning roller 36 is brought into contact with its
15 adhesive roller 40 as seen in Fig. 7. Conversely,
16 when the machine is not in operation each adhesive
17 roller 40 is caused to move out of contact with its
18 corresponding cleaning roller 36, as seen in Fig. 6.
19 The nature of this operation will be further
20 described below.

21

22 The axles of the adhesive rollers 40 are journaled
23 in flanged wheels 43 and are biased together at
24 their respective ends by means of tension springs
25 44, one of which is shown in Figs. 6 and 7. The
26 axles (hereinafter referred to as bearing axles)
27 engage oblique cartridge cam surfaces 46 formed in
28 moveable plates 48 each of which is slidably mounted
29 on the respective side member 38 by means of pins 50
30 and slots 52. The moveable plates 48 are biased by
31 tension springs 54 to the position seen in Fig. 6.

32

1 Each of the movable plates 48 is provided with a
2 pair of spaced upstanding pins or rollers 56 which
3 act as bearing members for engagement with the
4 inclined slots 32 in the opposing walls 16 of the
5 base unit 10.

6

7 In use, the roller cartridge 12 is inserted
8 vertically into the base unit 10. The opposing
9 walls 16 of the base unit 10 are formed with
10 straight shoulders 58 (Figs. 3 to 5) which act as
11 guides for the side members 38 of the roller
12 cartridge 12. The pins or rollers 56 define bearing
13 members which bear against the inclined slots 32.
14 Once inserted from the top, the roller cartridge 12
15 moves downwardly under the influence of gravity to
16 the condition shown in Figs. 2 and 6.

17

18 It will be appreciated that, during said downward
19 motion, no resistive forces are imparted on the
20 lowermost bearing members (i.e. pins or rollers) 56
21 by the vertical portions of the slots 32. However,
22 once the lowermost bearing members 56 reach the
23 bottom of the vertical portions of the slots 32, the
24 inclined portions of the slots 32 prevent further
25 downward motion. The roller cartridge 12 is
26 maintained in the position shown in Fig. 2 because
27 the spring force in tension springs 54 is sufficient
28 to prevent both the uppermost and lowermost bearing
29 members 56 from moving laterally and travelling down
30 the inclined parts of inclined slots 32.

31

1 By exerting manual downward pressure, a user can
2 move the roller cartridge 12 to the position shown
3 in Fig. 1. During this movement a camming action
4 between the inclined slots 32 and the pins or
5 rollers 56 brings the cartridge into the condition
6 shown in Fig. 7 causing the cleaning rollers 36 to
7 move into contact with their corresponding adhesive
8 rollers 40.

9

10 The surface cleaning apparatus is maintained in this
11 operational condition by means of an electromagnet
12 34 being activated to exert an attracting force on
13 an armature magnet 60 secured to the underside of
14 the cartridge 12. By connecting the electromagnet
15 34 in series with the driving motor 18, it can be
16 ensured that whenever the driving motor 18 is
17 deactivated, so also is the electromagnet 34 thus
18 allowing tension springs 44 and 54 to return the
19 apparatus to the condition of Figs. 2 and 6. It
20 will be appreciated by those skilled in the art that
21 other forms of latching mechanism could be used.

22

23 The surface cleaning apparatus of the present
24 invention thus provides a roller cartridge 12 which
25 can be removed and replaced in a simple manner for
26 maintenance or replacement of the rollers. The
27 surface cleaning apparatus also provides a
28 convenient and economical arrangement to ensure that
29 the cleaning rollers 36 do not remain in contact
30 with their adhesive rollers 40 when stationary, for
31 example when the power supply fails.

32

1 Fig. 8 shows an alternative and simplified
2 embodiment, in which a substantially complete
3 surface cleaning apparatus 112 is inserted sideways
4 in a simple base unit 110. The apparatus 112
5 contains the required drive motor and a latching
6 electromagnet, the armature magnet 160 being fixed
7 to the base unit 110. Fig. 8a shows slots 132 which
8 are laterally offset with respect to each other and
9 are engaged by offset pins 158 on opposing sides of
10 the apparatus 112.

11

12 Fig. 9 shows a concept similar to that of Fig. 8,
13 with a removable machine 212 being insertable in a
14 simple base unit 210 suitable for desk-top use.

15

16 The preferred embodiments of the invention thus
17 provide a surface cleaning apparatus which combines
18 the convenience of a roller cartridge with a simple
19 fail-safe means for avoiding stationary contact
20 between the cleaning rollers and the adhesive
21 rollers.

22

23 Modifications and improvements may be made to the
24 foregoing embodiments without departing from the
25 scope of the present invention. For example, whilst
26 the apparatus is adapted to cause the adhesive
27 rollers to move in a parallel manner with respect to
28 the cleaning rollers, it would also be possible to
29 separate and unite the rollers by means of a
30 pivoting motion. This could be achieved by
31 providing the interacting formations (i.e. the
32 inclined slots and bearing members) at one side only

1 whilst fixing the adhesive rollers in position at
2 the other side.

3

4 Moreover, whilst two oblique cartridge cam surfaces
5 46 are formed in the moveable plates 48 in Figs. 6
6 and 7, the invention could operate by fixing one of
7 the bearing axles in position and employing only one
8 oblique cartridge cam surface 46. In this way,
9 relative movement of the adhesive rollers 40 would
10 be achieved due to movement of the bearing axle of
11 the other adhesive roller along the cam surface 46.